

Proponents of greater hard-target capability also argue that an increase in the U.S. inventory of hard-target warheads might encourage the Soviet Union to deploy mobile command and control facilities and mobile ballistic missiles (either submarine-based, ship-based, or mobile land-based ballistic missiles). Mobile Soviet facilities would be difficult for the United States to target, potentially enhancing stability by increasing the survivability of the systems and thereby decreasing Soviet incentives to launch them upon warning of an attack. 16/

Finally, proponents of growth in the inventory of hard-target warheads have argued that such growth is an inevitable consequence of improving technology. A U.S. decision not to deploy such warheads would require forgoing the deployment of new missiles, limiting the accuracy of future missiles by retaining obsolescent technology, or reducing significantly the yield of warheads on future missiles. Meanwhile, since the accuracy of Soviet missiles continues to improve, the Soviet lead in hard-target capability would be compounded.

These arguments support the deployment of prompt hard-target warheads, but they do not provide a clear indication of how many are required. Some proponents believe that only a modest number (perhaps several hundred to a thousand) of such warheads are necessary, if deployed in a manner such that they would survive a Soviet attack. A modest number of such warheads, they argue, would accomplish the primary objective of enhancing deterrence, and, in the event deterrence fails, would provide U.S. leaders with the option of conducting prompt limited strikes against hardened targets. Larger attacks on hardened targets could be accom-

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16. Some analysts have noted that by encouraging the Soviet Union to deploy smaller mobile missiles in place of the large silo-based ICBMs, particularly the SS-18, the United States might also reap a side benefit by reducing the current Soviet advantage in ballistic missile throwweight. (Throwweight is the weight of the payload that a missile can deliver to a specified range. It is a measure of strategic capability because it determines the weight and number of warheads that each nation can deploy on ballistic missiles; it does not, however, reflect other important qualities such as range, reliability, the yield-per-weight ratio of the warheads, or their accuracy.)

It does not appear, however, that the potential reduction in Soviet throwweight will be realized. First, unless the missile ceilings imposed by SALT II endure--and they are in doubt following the recent U.S. decision to base future deployments on force requirements rather than on SALT ceilings--the Soviet Union would probably not continue to retire older missiles as it deploys new missiles. Even with SALT ceilings, the Soviet Union might choose to exchange the SS-11 and SS-13 for the road-mobile SS-25 and to exchange the SS-17 and SS-19 for the anticipated rail-mobile SS-24, leaving the major cause of the Soviet throwweight advantage--308 SS-18 missiles--untouched.

plished with weapons that take longer to arrive such as bomber-delivered bombs and ALCMs. Other proponents argue that it is important to provide U.S. leaders with a fuller set of options, possibly including the ability to attack promptly the entire set of hardened targets in the Soviet Union. To accomplish that more demanding mission, far more warheads would be required. For example, to attack the approximately 2,000 hardened strategic targets in the Soviet Union, 4,000 to 5,000 prompt hard-target warheads might be required.

#### Arguments Against Expanded Hard-Target Capability

Opponents of growth in hard-target capability argue that deterrence is currently strong and that the deployment of additional hard-target weapons would increase rather than decrease the probability that a crisis would escalate to nuclear war.

In regard to the deterrence of a massive Soviet strike, opponents argue that Soviet leaders value their society (citizens and their culture) and the country's economic infrastructure (industrial centers, transportation and communication networks, and agrarian resources) at least as much as they value the means (command and control centers and ballistic missile silos) to protect their society. Therefore, the fundamental deterrent to a massive Soviet strike is the U.S. capability to destroy Soviet cities, industrial centers, highways, pipelines, railroads, ports, airports, and their agrarian system--resulting in the end of the Soviet Union as a functioning society. That capability is not dependent on having hard-target warheads.

Opponents of hard-target capability also argue that an increase in that capability would not contribute to the deterrence of a limited Soviet strike. They reason that the Soviet Union is already deterred from launching a limited first strike because the risk of such a strike--namely, that it would start a nuclear war that would result in extensive damage to the Soviet Union--outweighs the potential military benefits. Consider, for example, the case of a limited Soviet first strike on U.S. ICBMs (in all other limited attacks on other targets, U.S. hard-target capability on MX and Minuteman ICBMs would survive for use in limited retaliatory options). Even if the Soviet attack destroyed all the U.S. ICBMs, the United States would still have roughly 5,000 SLBM warheads with which to retaliate against targets in the Soviet Union. Moreover, such an attack by the Soviet Union, which might require the detonation of nuclear warheads with a collective yield equivalent to between 65,000 and 80,000 times the yield of the nuclear bomb detonated over Hiroshima, would immediately kill 100,000 to 200,000 people

in the United States. <sup>17/</sup> Radioactive fallout eventually would kill millions more. <sup>18/</sup> Given this level of damage, it is doubtful that Soviet leaders would discount the possibility that the United States would retaliate after such an attack.

Opponents further argue that an expansion of hard-target capability is not needed to support the objectives stated in NSDM-242. As noted above, NSDM-242 is a U.S. planning document that concludes that the ability to retaliate against Soviet cities is inadequate to deter a limited Soviet strike or, in the event of nuclear war, to control escalation; to achieve these two objectives the United States needs retaliatory options against limited sets of nonurban facilities valued by the Soviet Union. Opponents of increasing hard-target capability argue, however, that the United States already has such options because of its ability to conduct limited strikes against many valuable soft targets other than Soviet cities including Soviet military bases, highways, railroads, pipelines, airfields, support centers for mobile missiles, electric power centers, oil fields, and other remote industrial sites.

Indeed, an expansion of hard-target capability could even undermine NSDM-242's second objective of employing a limited retaliatory strike, if nuclear war should occur, to limit escalation. An attack on Soviet ICBMs would entail a significant risk that the Soviet Union would launch their remaining ICBMs upon warning of the U.S. attack, greatly expanding the size of the war. Attacking Soviet command and control facilities would greatly complicate efforts to negotiate an end to the conflict.

The growth in U.S. hard-target capability, particularly if deployed on submarines, might in fact increase the likelihood of a crisis turning into a war rather than decrease it, as hard-target advocates believe. From the Soviet perspective, hard-target warheads are more threatening if based on SLBMs than on ICBMs; U.S. submarines can be deployed nearer to the Soviet Union, reducing the time between detection and arrival of an attack. Furthermore, if the United States has enough prompt hard-target capability to

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17. The estimate of collective yield is based on an attack by two SS-18 (Mod 4) warheads against each of the 1,000 ICBM silos in the United States. For estimates of deaths, see William Daugherty, Barbara Levi, and Frank von Hippel, "The Consequences of "Limited" Nuclear Attacks on the United States," *International Security* (Spring 1986), p. 36.

18. It is commonly postulated that an attack on a silo with one or two nuclear weapons would include at least one surface burst to maximize the size of the crater and the amount of shock transmitted through the ground. Such surface bursts, however, result in high amounts of radioactive fallout as debris scoured from the ground falls back to earth downwind, exposing humans to significant radioactivity and contaminating soil and water in large areas of the country.

attack and destroy a high percentage of the Soviet strategic facilities, the Soviet Union would have to assume that the United States might consider employing that capability in a first strike. To counter this threat, the Soviet Union might be more likely during a crisis to prepare to launch their ICBMs upon warning of an attack. Such a "launch-on-warning" policy, in which procedures for double-checking evidence of an attack and for authorizing the launch of ICBMs are minimized, might increase the chance of an unauthorized launch or a launch based on incorrect information.

Hard-target warheads could decrease crisis stability in other ways as well. If Soviet silo-based ICBMs are more vulnerable, Soviet leaders might be more likely during a crisis to implement measures to increase the survivability of other Soviet strategic forces, possibly increasing the level of tension or hostilities. Such measures might include earlier dispersion of strategic bombers or mobile missiles, which would increase U.S. concerns of a pending Soviet attack. The Soviet Union might also take more aggressive actions such as seeking to blind U.S. satellite-borne sensors or responding more forcefully to attacks on Soviet submarines carrying SLBMs.<sup>19/</sup> All these measures could increase the chance that a crisis might escalate to nuclear war.

Nor is it obvious, argue opponents of expanded U.S. prompt hard-target capability, that stability would be increased if U.S. prompt hard-target warheads cause Soviet leaders to place greater emphasis on mobile nuclear forces. Stability should be enhanced if a nation has well-protected weapon systems, resulting in little incentive either for a potential aggressor to attack or for the defender to launch on warning of an attack. Mobile systems are generally protected by their ability to change locations and thus escape detection. But the Soviet Union has already protected its ICBMs with hard silos. Developing the capability to destroy these silos to encourage Soviet leaders to adopt a new survivable basing system would simply exchange one relatively stable situation for another while fueling the arms race. Furthermore, argue opponents, the United States might find that the remodeled Soviet force structure would have some undesirable features. First, Soviet leaders might choose to deploy new mobile systems without dismantling all its ICBMs in silos, leaving the possibility that they might employ a launch-on-warning policy during a crisis to protect the silos from U.S. prompt hard-target warheads. Second, mobile missiles might be inherently difficult to count, complicating verification of future force limits.

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19. The U.S. Navy has stated that the United States would seek to destroy Soviet submarines carrying SLBMs if the United States and the Soviet Union were engaged in a conventional conflict.

Finally, opponents of hard-target capability do not believe that the deployment of hard-target capability is the inevitable result of improving technology. For example, the United States could limit the hard-target capability of more accurate missiles by decreasing the yield of the warheads. <sup>20/</sup> Such missiles would have several advantages. The lower yield of the warheads in combination with improved accuracy would decrease collateral damage--that is, unintended damage to facilities and urban areas near the intended target. Also, since warheads of lower yield would also weigh less, the United States could increase the range of a missile, put more warheads on a missile, or devote more of a missile's payload to devices that ensure that the warheads would penetrate Soviet defenses.

Therefore, conclude opponents, the deployment of additional U.S. prompt hard-target capability would not serve U.S. national interests. Rather, it would fuel another round in the arms race while decreasing nuclear stability. If the United States is threatened by the current Soviet lead in hard-target capability, they argue, the best response is not to mimic the Soviets but to decrease the vulnerability of U.S. weapon systems and command and control facilities, as is currently being done.

Important arguments clearly exist both for and against expanding hard-target capability. The Administration's position on this issue is, however, unambiguous. It believes that expanding that capability is necessary and plans to deploy the Trident II missile accordingly.

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20. If warheads with a yield of 25 kt were deployed on the Trident II, the SSKP of the warheads would be comparable to the SSKP of the 100-kt Mark 4 warhead on the Trident I missile.

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## CHAPTER III

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# ANALYSIS OF THE ADMINISTRATION'S PLAN AND ALTERNATIVES

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Over the next 15 years, the largest change proposed by the Administration in the U.S. ballistic missile forces will be the replacement of Poseidon and Trident I SLBMs with Trident II SLBMs (see Figure 7). Trident I missiles currently are carried on 12 Poseidon submarines and seven Trident submarines. Trident I missiles will also be deployed on the eighth Trident submarine, which is currently on sea trials. By the year 2000, however, all Trident I missiles would be retired and Trident II missiles would be deployed on 20 Trident submarines. <sup>1/</sup> The first eight Trident submarines would be backfitted with Trident II missiles when they are overhauled approximately 10 years after initial deployment. The Trident II would be deployed as original equipment on the ninth through twentieth Trident submarines beginning in fiscal year 1990.

The Trident II missiles deployed on these 20 submarines would carry approximately 4,800 nuclear warheads, each with a significant capability to destroy a hardened target. These warheads, in combination with ICBM warheads, would give the United States about 6,800 deployed prompt hard-target warheads. This increase would represent a fundamental shift in U.S. capability, enabling the United States to conduct large-scale attacks on hardened targets in the Soviet Union.

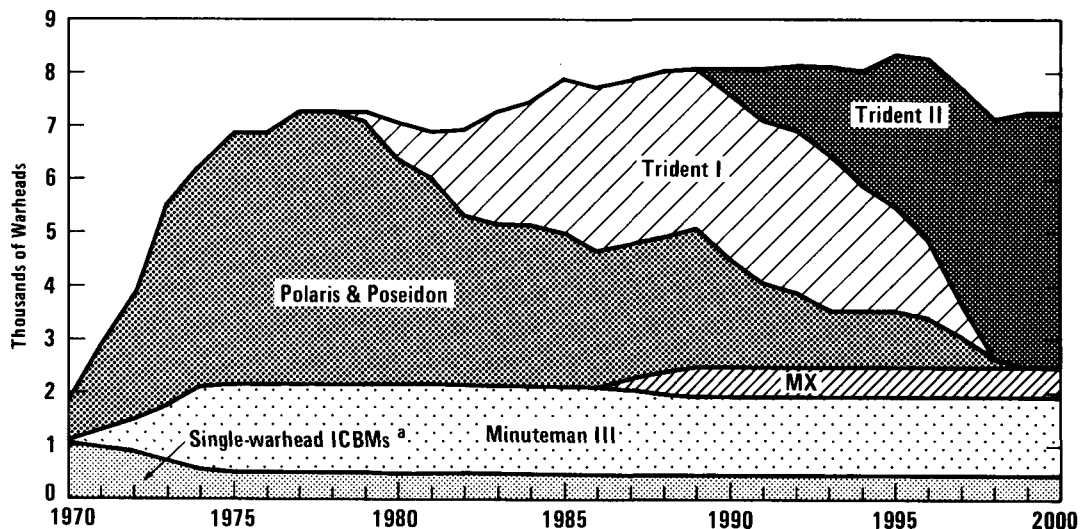
## CBO ASSUMPTIONS

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To evaluate both the Administration's plan to deploy the Trident II and alternatives to that plan, several assumptions must be made about Trident II missiles and other missiles in the U.S. inventory. First, as noted in Chapter I, a Trident II missile could carry about 11 to 13 Mark 4 warheads or six to nine Mark 5 warheads to a range comparable to that of the Trident I missile, or it could carry fewer Mark 4 or Mark 5 warheads to a greater range. The Congressional Budget Office (CBO) assumed that the Navy

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1. The Navy has not stated whether it will seek more than 20 Trident submarines. The Navy is using 20 Trident submarines, however, as the planning figure for the design of base facilities.

Figure 7.  
Number of U.S. Ballistic Missile Warheads, Historically and Under the  
Administration's Plan, Fiscal Years 1970-2000



SOURCE: Congressional Budget Office.

<sup>a</sup> Includes Titan II, Minuteman I, and Minuteman II.

would choose to emphasize payload over range and that, for the purpose of illustrating force capabilities, the Trident II would carry either 12 Mark 4 warheads or eight Mark 5 warheads. (Twelve and eight are the midpoints of the intervals noted above, rounded to the nearest integer.)

The capability of the U.S. Trident II force would also depend on the mix of Trident II missiles deployed with the smaller Mark 4 warheads rather than Mark 5 warheads. For the purpose of comparing options, CBO assumed that half of the missiles would carry the Mark 4 and half would carry the Mark 5. <sup>2/</sup> This ratio has a significant effect on the capability of the Trident II missile force because the Trident II is more effective against soft targets if deployed with the larger number of Mark 4 warheads but is more effective against very hard targets if deployed with Mark 5 warheads. The effects of varying this ratio, which Congress might choose to consider, are presented in Appendix B.

2. The Navy's final plan for the mix of Trident II missiles with Mark 4 warheads and Trident II missiles with Mark 5 warheads will probably depend on the missions assigned to the Trident II in the future.



The capability of U.S. strategic ballistic missiles under the Administration's plan and the alternatives presented in this study would also depend on which older missiles the United States chooses to retire. Under the limits of the SALT II agreement (Strategic Arms Limitation Talks), which has not been ratified by the United States, this country would have to retire older strategic ballistic missiles with MIRVs as Trident submarines enter the fleet. The United States has done so to date, dismantling one Poseidon submarine when the seventh Trident submarine entered the fleet and two Poseidon submarines as the eighth Trident submarine began sea trials in May 1986. The Administration indicated when it retired the two Poseidon submarines in May, however, that future retirement decisions will be based on force requirements and the cost to overhaul the weapon system rather than on SALT limits. This study assumes that, on the basis of cost and force requirements, the United States would continue to retire aging Poseidon submarines as additional Trident submarines enter the fleet, resulting in the same retirement schedule as had been planned under SALT II limits. If the United States decided to maintain the Poseidon submarines for a longer period, the total number of ballistic missile warheads associated with the Administration's plan would be higher. That decision would have very little effect on U.S. hard-target capability, however, since no hard-target warheads are deployed on Poseidon submarines.

Finally, U.S. prompt hard-target capability under the Administration's plan and the alternatives would be affected by the procurement of additional ICBMs. This study assumes that although the Administration is requesting that the Congress approve deployment of an additional 50 MX missiles, for a total of 100 deployed MX missiles, only 50 MX missiles would be deployed as currently approved by the Congress. Also, although the Administration is considering the procurement of a small mobile ICBM carrying one to three warheads, that missile has not been included in the Administration's plan in this study since its characteristics and the number to be procured have not yet been determined.

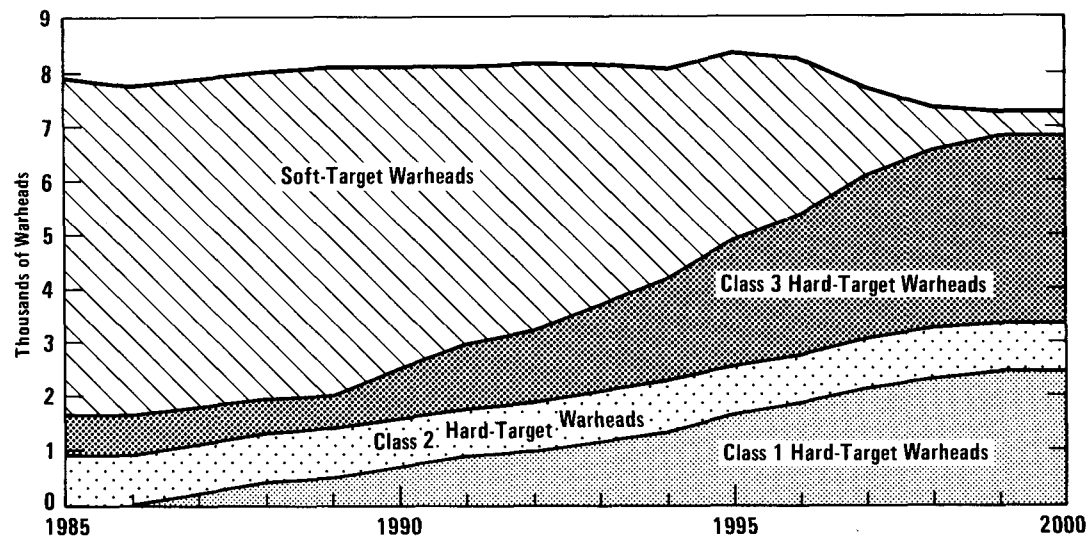
### THE ADMINISTRATION'S PLAN

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The Administration's plan to deploy 20 Trident submarines equipped with Trident II missiles by the year 2000 would greatly expand U.S. prompt hard-target capability. Between 1986 and the year 2000, given the assumptions noted above, the number of Class 1 ballistic missile warheads deployed by the United States would grow from zero to more than 2,400--about 80 per-

Figure 8.

Number of U.S. Ballistic Missile Warheads, by Class,  
Under the Administration's Plan, Fiscal Years 1985-2000



SOURCE: Congressional Budget Office.

NOTE: Warheads are classified here by their Single Shot Kill Probability (SSKP) — the probability that an arriving warhead will destroy a target of given hardness. Class 1 warheads have an SSKP of at least 70 percent against a 5,000-psi target. Class 2 warheads do not meet that standard but have an SSKP of at least 70 percent against a 2,000-psi target. Class 3 warheads do not meet either of those standards but have an SSKP of at least 70 percent against a 500-psi target. All other warheads are soft-target warheads.

cent of which would be Mark 5 warheads on Trident II missiles (see Figure 8). The number of Class 2 ballistic missile warheads would remain constant during that period at 900 warheads. The number of Class 3 ballistic missile warheads would grow from 750 to about 3,500, more than 80 percent of which would be Mark 4 warheads on Trident II missiles. As the number of hard-target warheads on ballistic missiles increases, the number of soft-target warheads on ballistic missiles would correspondingly decline—from about 6,100 in 1986 to less than 500 in the year 2000. The total number of ballistic missile warheads would therefore be largely unchanged.

### Effect on Capability

Measures of capability against two hypothetical sets of hardened targets—a large set of 2,000 facilities and a small set of 500 facilities—also reflect the

large contribution that the Trident II missile would make to U.S. prompt hard-target capability under the Administration's plan. With the current (1986) inventory of ICBMs and SLBMs, the United States could destroy 59 percent of the large target set hardened to 2,000 psi and 42 percent of the large set hardened to 5,000 psi (see Figure 9). <sup>3/</sup> By the year 2000, these percentages would increase to 90 percent and 81 percent, respectively.

Following an effective attack on U.S. silo-based ICBMs, however, the capability of U.S. forces to retaliate would be reduced. It is therefore useful to assess the capability of U.S. SLBMs--most of which would be expected to survive a Soviet attack--independently from U.S. ICBMs (see Figure 10). In 1986, U.S. SLBMs could destroy 28 percent of the target set hardened to 2,000 psi and 17 percent of the set hardened to 5,000 psi. By the year 2000, the percentage of targets destroyed would have increased to 85 percent and 73 percent, respectively. Thus, as more Trident II missiles were deployed, the absence of ICBMs (including the MX ICBM) would have a decreasing effect on U.S. prompt hard-target capability.

The effectiveness of the U.S. prompt hard-target warheads also would depend on the size of the time-urgent target set against which they were directed. The size of that target set would depend in turn on the missions envisioned for these warheads. As discussed in Chapter II, some proponents of expanded U.S. hard-target capability argue that it is important to provide U.S. leaders with a wider range of options, possibly including the ability to attack promptly the entire set of strategic targets in the Soviet Union. In that situation, the target set could include about 2,000 sites as evaluated in Figures 9 and 10. Other proponents of expanded hard-target capability, however, believe that U.S. ability to retaliate with prompt hard-target warheads against a smaller target set would fulfill U.S. national security objectives, including the primary objective of enhancing deterrence. Figure 11 accordingly illustrates the capability of U.S. SLBM warheads against a much smaller target set of 500 hardened facilities. Against this target set, the first four Trident submarines deployed with Trident II missiles would greatly increase U.S. capability, while missiles on subsequent submarines would have less of an impact.

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3. The precise results of CBO's calculations are given for the purpose of comparing performance over a span of years and among the various plans. They should be used for comparative purposes only because many assumptions cannot be established with certainty. For example, many of the point estimates that are required for these calculations--including missile system reliability and warhead accuracy--are chosen from a distribution of potentially correct values.

Figure 9.  
Administration's Plan:  
Performance of U.S.  
ICBMs and SLBMs  
Against a Large  
Target Set, Fiscal  
Years 1985-2000

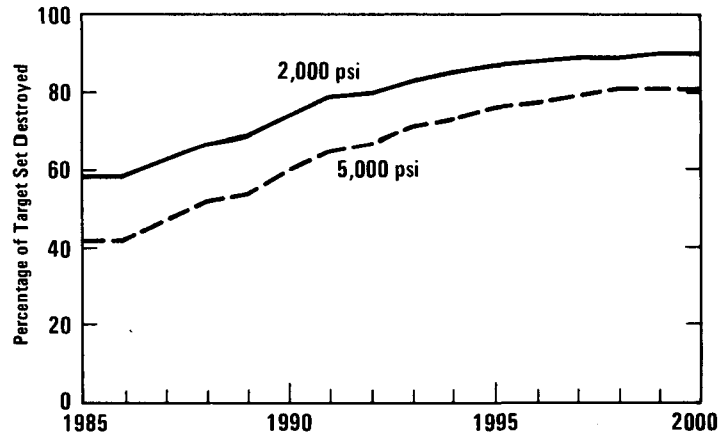


Figure 10.  
Administration's Plan:  
Performance of U.S.  
SLBMs Against a  
Large Target Set,  
Fiscal Years  
1985-2000

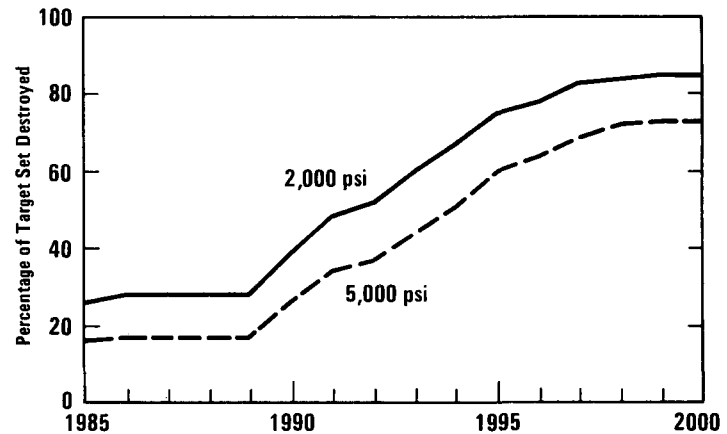
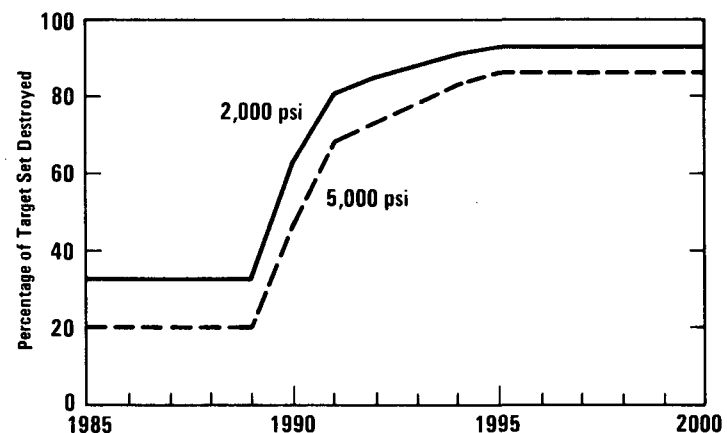


Figure 11.  
Administration's Plan:  
Performance of U.S.  
SLBMs Against a  
Small Target Set,  
Fiscal Years  
1985-2000



SOURCE: Congressional Budget Office.

NOTES: A large target set (Figures 9 and 10) is 2,000 facilities; a small target set (Figure 11) is 500 facilities. All three figures illustrate the performance of ballistic missiles against target sets hardened to 2,000 psi and 5,000 psi. The calculations are based on the assumptions that no more than two warheads are allocated against any one target and that the reliability of SLBMs is 80 percent. U.S. warheads are allocated to maximize the percentage of targets destroyed.

### Effect on Costs

To provide the Trident II missiles required for flight tests and deployment on 20 submarines, the Administration currently plans to procure 844 missiles over 13 years. The cost in fiscal year 1987--for ongoing research and development and procurement of the first 21 missiles--would be \$3.1 billion, of which \$1.6 billion is for research and development. The cost in fiscal year 1987 dollars over the first five years of the program, during which 291 missiles would be procured, would be \$13.4 billion. During that period, research and development of the missile would be completed at a cost of \$3.4 billion. Finally, the total cost of development and procurement of the missile (fiscal years 1987 through 1999) would be about \$26.1 billion (see Table 4). Although all budget figures in this paper are in fiscal year 1987 dollars, Table 4 also includes total program costs for the Administration's plan in discounted dollars to portray the real cost in current resources of different options pursued over long periods of time. <sup>4/</sup>

Procurement of the Trident II missile, however, would account for only a portion of the cost of the Administration's plan. It would be necessary to operate Poseidon submarines until they are replaced by Trident submarines and to flight-test Trident I missiles until they are replaced by Trident II missiles. In addition, the first eight Trident submarines would have to be modified to carry the Trident II rather than the Trident I missile at a cost of about \$305 million for the first submarine and \$225 million for each of the remaining seven submarines. Modifications would include replacing existing launch tubes with larger launch tubes and substituting a more powerful gas ejection system. Numerous support systems, such as the navigation and fire control subsystems, also would have to be changed. In addition to these changes, seven more Trident submarines would have to be procured (funds for the fourteenth have been requested in fiscal year 1987), and all 20 Trident submarines would have to be operated over their approximately 35-year life span. Finally, to uncover and correct problems in the Trident II missiles and to update operational parameters for the Single Integrated Operational Plan (the nation's blueprint for conducting nuclear war), 352 Trident II flight

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4. Discounting is a way to calculate, in today's dollars, the value of a future expenditure or a stream of future annual expenditures. The result is called present value. A future expenditure is discounted to its present value with the following formula:

$$\text{Present Value} = \text{Future Value}/(1 + i)^n$$

In this formula, "n" is the number of years between the present year and the year in which the expenditure is made, and "i" is the discount rate. Future value is in fiscal year 1987 dollars. The discount rate used in this analysis is 4 percent in real terms.

TABLE 4. PROCUREMENT AND COSTS FOR THE ADMINISTRATION'S TRIDENT II PROGRAM AND ALTERNATIVES  
(By fiscal year in billions of 1987 dollars of budget authority)

Number of Missiles Procured and Costs	1987	1988	1989	1990	1991	Total 1987- 1991	Total Program (1987-2030)	Total Pro- gram in Discounted Dollars <u>a/</u>
<b>Administration's Plan</b>								
Trident II Missiles	21	66	66	66	72	291	844	--
Costs								
Investment <u>b/</u>	3.1	3.3	2.8	2.4	1.8	13.4	26.1	21.7
Other <u>c/</u>	<u>4.3</u>	<u>4.3</u>	<u>4.4</u>	<u>4.3</u>	<u>4.4</u>	<u>21.7</u>	<u>78.5</u>	<u>49.3</u>
Total	7.4	7.6	7.2	6.7	6.2	35.1	104.6	71.0
<b>Alternative 1: Cancel Backfits</b>								
Trident II Missiles	21	66	66	66	72	291	660	--
Costs								
Investment <u>b/</u>	3.1	3.3	2.8	2.4	1.8	13.4	21.5	18.7
Other <u>c/</u>	<u>4.3</u>	<u>4.3</u>	<u>4.2</u>	<u>4.2</u>	<u>4.2</u>	<u>21.2</u>	<u>77.8</u>	<u>48.6</u>
Total	7.4	7.6	7.0	6.6	6.0	34.6	99.3	67.3
Savings from Admin. plan	<u>d/</u>	<u>d/</u>	0.2	0.1	0.2	0.5	5.3	3.6
<b>Alternative 2: Reduce and Delay Procurement of Trident II Missiles</b>								
Trident II Missiles	0	0	0	35	72	107	516	--
Costs								
Investment <u>b/</u>	2.1	2.1	2.5	2.3	2.5	11.5	22.8	19.2
Other <u>c/</u>	<u>4.9</u>	<u>4.7</u>	<u>4.2</u>	<u>4.2</u>	<u>4.2</u>	<u>22.2</u>	<u>78.9</u>	<u>49.6</u>
Total	7.0	6.8	6.7	6.5	6.7	33.7	101.7	68.8
Savings from Admin. plan	0.4	0.8	0.5	0.2	(-0.5)	1.4	2.9	2.2
<b>Alternative 3: Cancel Trident II Program</b>								
Trident I Missiles	0	0	0	25	60	85	395	--
Costs								
Investment <u>b/</u>	2.1	2.1	2.4	2.2	1.8	10.6	16.4	14.3
Other <u>c/</u>	<u>4.9</u>	<u>4.7</u>	<u>4.4</u>	<u>4.3</u>	<u>4.2</u>	<u>20.5</u>	<u>78.6</u>	<u>49.5</u>
Total	7.0	6.8	6.8	6.5	6.0	33.1	95.0	63.8
Savings from Admin. plan	0.4	0.8	0.4	0.2	0.2	2.0	9.6	7.2

SOURCE: Congressional Budget Office.

NOTE: Budget figures do not include the cost of procuring ballistic missile warheads. These costs, which are paid by the Department of Energy, are classified.

- The discount rate is 4 percent. Discounting converts a stream of future dollar amounts to their value in an earlier year, reflecting the notion that a dollar held in the future is worth less than one held today. Discounted dollars are a better measure of the cost in current resources of an expenditure stream over an extended period.
- Includes research and development, procurement, and military construction for the Trident missiles.
- Includes operating and support costs for the Trident and Poseidon submarines; flight tests for Trident I and Trident II missiles; procurement of Trident submarines; converting the first eight Trident submarines to carry Trident II missiles (if applicable); and converting submarines under construction to carry Trident I missiles (if applicable).
- Savings in fiscal year 1987 would be \$2.5 million; in fiscal year 1988, \$63 million.

tests are planned. These tasks would raise the total program cost for fiscal years 1987 through 2030, when the Trident force would be largely retired, to about \$105 billion.

While the costs of deploying SLBMs under the Administration's plan are substantial, they account for less than a third of the total U.S. budget for strategic forces. Which programs should be included in that budget is often debated. By the Department of Defense's definition, however, the proposed fiscal year 1987 budget for strategic forces is \$25.4 billion, rising to \$29.7 billion (current year dollars) by 1989. As a percentage of the total strategic budget proposed by the Administration, budget authority for the Trident II missile and associated costs detailed above would range from 29 percent in fiscal year 1987 to 25 percent in fiscal year 1989.

The Administration's plan for the Trident II missile would involve substantial costs and a dramatic expansion of U.S. prompt hard-target capability. If the Congress wishes to hold down costs or slow the growth of hard-target capability, the Administration's plan could be modified in several ways. Alternatives considered in this study include not backfitting the Trident II missile into the first eight Trident submarines, and reducing and delaying procurement of the Trident II missile such that it is deployed only on the last eight Trident submarines. A third option would be to cancel the Trident II program and deploy only the Trident I missile on all 20 Trident submarines.

#### ALTERNATIVE 1: CANCEL PLAN TO BACKFIT TRIDENT SUBMARINES WITH TRIDENT II MISSILES

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This alternative would eliminate the current plan to backfit the eight Trident submarines, which are currently designed to carry Trident I missiles, with Trident II missiles. Only the last 12 of the 20 Trident submarines would be deployed with Trident II missiles, reducing Trident II procurement from 844 missiles under the Administration's plan to 660. 5/

To support the extended deployment of the Trident I missile, its flight-test program would be continued until the year 2012. Although that

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5. Since in some years a maximum of 12 submarines would be deployed with Trident II missiles rather than 19 submarines as under the Administration's plan (of the 20 Trident submarines, one would always be undergoing an overhaul), seven fewer shiploads of missiles would have to be procured. In addition, the Demonstration and Shakedown Operations (DASO) program would be reduced by 16 missiles. Trident II procurement therefore would be reduced by 184 missiles  $((7 \times 24) + 16 = 184 \text{ missiles})$ .

extended test program would require 146 Trident I missiles, no additional Trident I missiles would have to be procured; rather, the increased demand would be met by Trident I missiles currently in the stockpile or deployed aboard Poseidon submarines scheduled for retirement.

In other respects, this alternative is identical to the Administration's plan. Although the first backfit of a Trident submarine with Trident II missiles is not scheduled until 1991, the Congress could indicate its intention to pursue this option by deleting \$2.5 million in fiscal year 1987 budget authority, which is designated to provide advance planning and to begin procurement of long-lead items for converting the eight submarines.

#### Effect on Capability

Although the United States would have fewer hard-target warheads in the year 2000 with this option than under the Administration's plan, this lower level of capability would have only a small effect on the U.S. ability to conduct retaliatory strikes on either large or small sets of time-urgent hardened targets in the Soviet Union.

Under this alternative, in the year 2000 the United States would have about 4,880 prompt hard-target warheads rather than 6,800 as under the Administration's plan. The reduction would occur in Class 1 hard-target warheads (from 2,420 to about 1,650) and in Class 3 (from 3,480 to about 2,330). The number of Class 2 warheads would not change (see Figure 12). Deployed capability under this alternative would be the same as under the Administration's plan until 1992, when backfitted submarines would begin to enter the fleet.

The decrease in the number of U.S. prompt hard-target warheads under this option would have a small effect on their performance against target sets of hardened facilities. As in the analysis of the Administration's plan, CBO used two target sets to reflect various assumptions. If U.S. ICBMs and SLBMs were both available to attack a large set of 2,000 targets hardened to 2,000 psi, performance in the year 2000 would decrease from the destruction of 90 percent of the targets under the Administration's plan to 87 percent (see Figure 13). <sup>6/</sup> If only U.S. SLBMs were available, reflecting the mission of a retaliatory strike, performance against that target

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6. To simplify presentation, only the changes in capability against target sets hardened to 2,000 psi are shown here. Comparable changes occur in target sets hardened to 5,000 psi (see Appendix C).

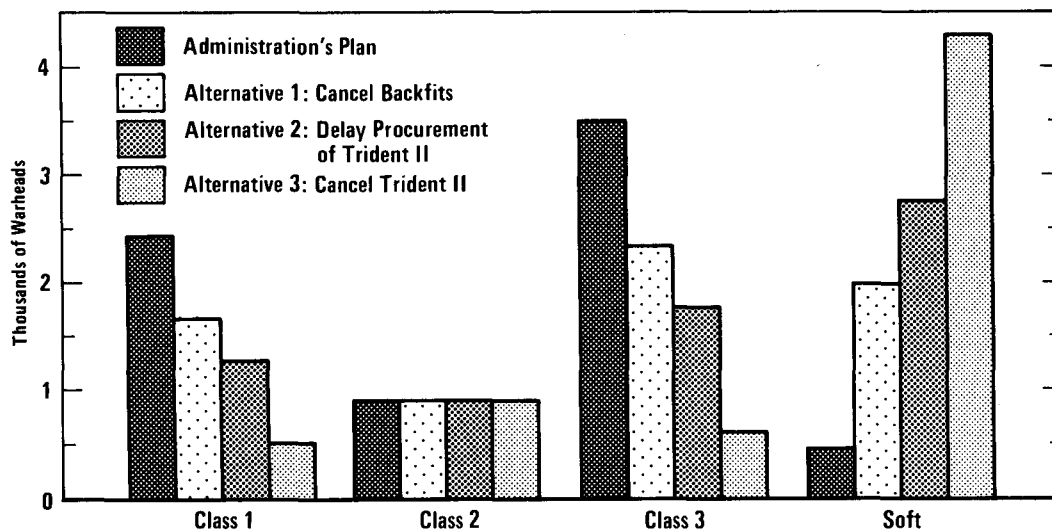


set would decrease from the destruction of 85 percent of the targets to 75 percent (see Figure 14). The performance of U.S SLBMs against a smaller set of 500 facilities, reflecting the mission of conducting a limited retaliatory strike, would be the same under this alternative and the Administration's plan (see Figure 15).

### Effect on Costs

About \$5.3 billion would eventually be saved under this option, reflecting procurement of 184 fewer Trident II missiles and cancellation of plans to modify the first eight Trident submarines to carry the Trident II missiles (see Table 4). These savings constitute only about 5 percent of the total cost (including procurement and operation of Trident submarines) of deploying Trident II SLBMs under the Administration's plan. In addition, savings in fiscal years 1987 and 1988 would be small; the only change in those years would be the elimination of funds for planning and for procuring long-lead items to modify the eight Trident submarines.

Figure 12.  
Number of U.S. Ballistic Missile Warheads, by Class, in Fiscal Year 2000 Under the Administration's Plan and Alternatives



SOURCE: Congressional Budget Office.

NOTE: Warheads are classified here by their Single Shot Kill Probability (SSKP)—the probability that an arriving warhead will destroy a target of given hardness. Class 1 warheads have an SSKP of at least 70 percent against a 5,000-psi target. Class 2 warheads do not meet that standard but have an SSKP of at least 70 percent against a 2,000-psi target. Class 3 warheads do not meet either of those standards but have an SSKP of at least 70 percent against a 500-psi target. All other warheads are soft-target warheads.

Figure 13.  
Administration's Plan  
and Alternatives:  
Performance of U.S.  
ICBMs and SLBMs  
Against a Large Target  
Set, Fiscal Years  
1985-2000

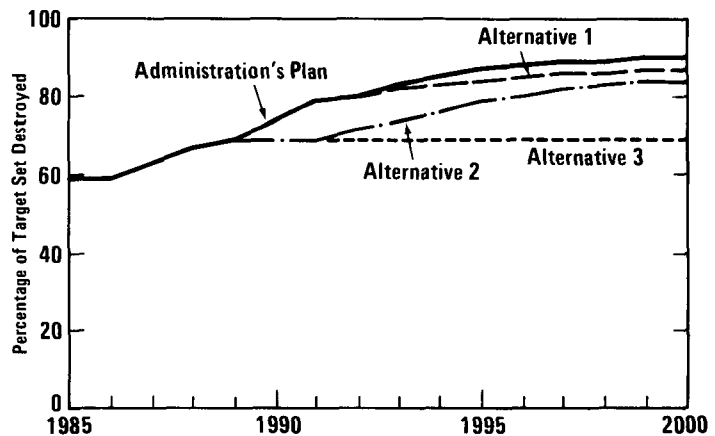


Figure 14.  
Administration's Plan  
and Alternatives:  
Performance of U.S.  
SLBMs Against a Large  
Target Set, Fiscal  
Years 1985-2000

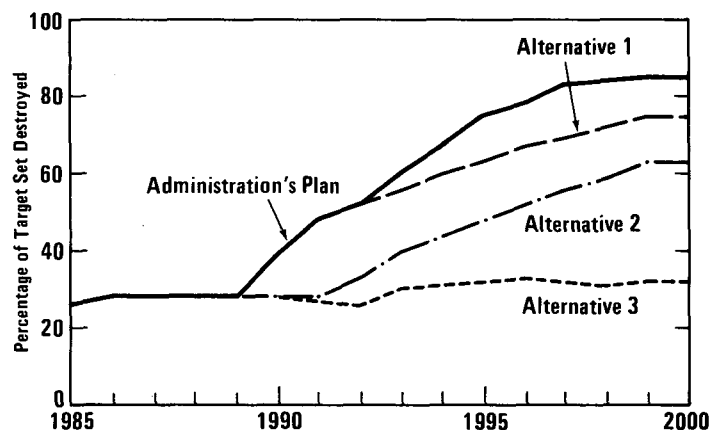
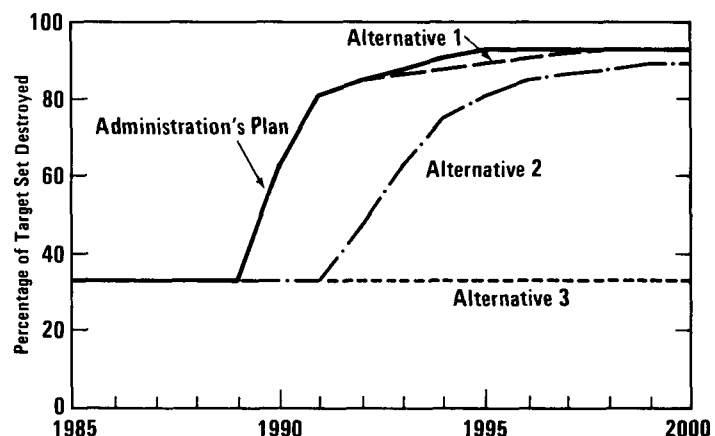


Figure 15.  
Administration's Plan  
and Alternatives:  
Performance of U.S.  
SLBMs Against a Small  
Target Set, Fiscal  
Years 1985-2000



SOURCE: Congressional Budget Office.

NOTES: A large target set (Figures 13 and 14) is 2,000 facilities; a small target set (Figure 15) is 500 facilities. All three figures illustrate the performance of ballistic missiles against target sets hardened to 2,000 psi. The calculations are based on the assumptions that no more than two warheads are allocated against any one target and that the reliability of SLBMs is 80 percent. U.S. warheads are allocated to maximize the percentage of targets destroyed. Alternative 1 = Cancel Backfits; Alternative 2 = Delay Procurement of Trident II Missiles; Alternative 3 = Cancel Trident II Program.

Savings from buying fewer Trident II missiles would not be offset by the cost of buying more Trident I missiles, since the number of Trident I missiles in storage and on retiring Poseidon submarines would be sufficient to supply the eight Trident submarines and a flight-test program. Thus, this option would make fuller use of Trident I missiles already procured than would the Administration's plan.

### Other Effects

A sufficient number of Trident I missiles would be available to continue flight-test programs. Specifically, the Trident I Follow-on Operational Test (FOT) program, which updates estimates of missile reliability and accuracy, could be extended through the year 2012 at eight missiles per year. This alternative also would provide for additional Trident I DASO (Demonstration and Shakedown Operations) flights. A DASO flight consists of the test flight of a single missile from a submarine that has just completed a major overhaul; this flight provides a final check of the ship's capability before the ship is deployed. If backfits were canceled, eight Trident submarines would go through two additional overhauls while carrying the Trident I missile, requiring 16 DASO flights. This alternative would also decrease the number of Trident II DASO flights by 16 missiles to reflect the reduced number of ships carrying the Trident II but would maintain the remainder of the Trident II test program at the currently planned level.

Finally, this option would pose the issue of determining how many Trident submarines carrying each type of missile would be located at bases in Bangor, Washington, on the Pacific Ocean, and at Kings Bay, Georgia, on the Atlantic Ocean. The current plan is to station the first eight Trident submarines carrying Trident I missiles at Bangor and to station the next 8 to 10 submarines, which would carry Trident II missiles, at Kings Bay. Eventually, 20 Trident submarines, all carrying Trident II missiles, would be split between the two bases. Under this alternative, that plan would have to be modified. Either additional equipment would have to be installed at Kings Bay to handle some of the eight Trident submarines permanently deployed with Trident I missiles, or all eight submarines would have to be deployed at Bangor. In the latter case, only Trident submarines with Trident II missiles would be based at Kings Bay whereas most of the submarines based at Bangor would carry Trident I missiles. Far more hard-target warheads would therefore be deployed in the Atlantic than in the Pacific, possibly causing less than an optimal allocation of warheads to targets in the Soviet Union.